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Working title: Physical Activity May Mitigate COVID-19 Infections In People With Obesity:
A Call to Action

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kids and also sits on the World Federation of Sporting Goods Physical Activity Committee and Head of Social Purpose for Reebok International.

At the start of the COVID-19 pandemic in the US, 42.5% of adults and 18.5% of children had obesity^{1,2} and less than 50% of the population met physical activity recommendations.³ Emerging evidence indicates that physical activity declined during the pandemic, likely due in part to school closures and restricted access to common indoor and outdoor places where people are active. Public health interventions are urgently needed to promote an active lifestyle and engagement in physical activity to mitigate the physical and mental adverse impact of COVID-19.⁴

The association between obesity and the increased risk of COVID-19 infections, hospitalizations, intensive care unit admissions and death is unequivocal.^{5,6} Furthermore, obesity increases the risk of intubation and death in patients less than 65 years old infected with COVID-19, independent of diabetes and hypertension.⁷ Although children and adolescents are less likely to have severe COVID-19 infections, obesity is the most common co-morbidity among hospitalized pediatric⁸ and 18-34 year old young adult patients.⁹ Factors that contribute to these associations include impaired respiratory function, chronic inflammation associated with obesity, and impaired immune function during childhood and adulthood.¹⁰ Reduced ventilatory capacity with decreased chest wall compliance and increased intra-abdominal adiposity with reduced diaphragmatic excursion increase the work of breathing. Low grade chronic inflammation with increased cytokines, interleukins, and tumor necrosis factor may heighten the inflammatory response to the coronavirus.¹¹

Physical activity benefits for preventing or reducing body fat gain, undesirable fat distribution, and improved health for people with obesity are well documented.³ The role of physical activity in mitigating COVID-19 severity underscores its promise¹² as a public health strategy.¹³ A recent study using electronic health records demonstrated that meeting physical activity guidelines was strongly associated with a reduced risk for severe COVID-19 outcomes among infected adults¹⁴, even after adjusting for multiple chronic conditions.

Published reviews have demonstrated that physical activity enhances immune function and reduces inflammation, which directly reduce infectious disease severity¹². Antibody responses to hepatitis A,

hepatitis B, Influenza A, tetanus, and rabies vaccines suggest a decrease in immune responsiveness among people with obesity.¹⁵ However, physical activity substantially increases the percent of older adults who have a sufficient antibody response to certain vaccines.¹⁶ The relationship between physical activity and the risk of upper respiratory infections is J-shaped, and may be mediated by the effects of physical activity on immune function.¹⁷ Together, these observations suggest that physical activity may play a vital role in preventing and mitigating COVID-19 infections in people with obesity.

Stress levels have increased in response to the pandemic because of health concerns, food insecurity, job loss, racial injustice, political unrest, and social isolation.¹⁸ In addition to psychological distress, imbalances in cortisol interfere with immune function and inflammation control. Physical activity is one of the most effective strategies for preventing and treating anxiety and depression, as well as for rebalancing cortisol.¹³ In addition to the mental health benefits, moderate-intensity physical activity produces strong immune and inflammatory benefits, and most of the beneficial compounds are synthesized in, or stimulated by, active skeletal muscles. Because skeletal muscle constitutes 30-40% of body weight, active muscles distribute positive effects throughout the body.¹³

In response to the pandemic, physical activity has declined, particularly among low-income individuals.^{19,20} In children, the reduction of regular, structured physical activity through the absence of physical education, reduced sports and activities, and closure of parks and other activity facilities have likely increased childhood obesity and widened disparities.^{21,22} Increased isolation is worsening mental health and inactivity, both of which impair immune function, further increasing susceptibility to COVID-19 infections. The established relationship between physical activity and immune function has the potential to mitigate the effects of COVID-19 and improve vaccine response in all people, including those with obesity. In summary, all of these documented effects emphasize that moderate-intensity activities, such as walking, could have immediate beneficial impacts on immune function, inflammatory responses, mental health and vaccine responsiveness, all of which could reduce the severity of COVID-19 in people with obesity.

Supporting Active Lifestyles During the Pandemic

The sporting goods, fitness and wellness sectors, not-for-profits and many individuals reacted swiftly to COVID-19 restrictions by providing free digital tools to help anyone, anywhere, be active. Many companies adjusted to remote work, found ways to implement flextime, and provided free physical activity and stress resources. The World Health Organization has long recognized the need to increase physical activity and responded to the COVID-19 restrictions by creating the #healthathome campaign in addition to promoting and promising to hold itself to The Global Action Plan on Physical Activity 2018 - 2030.²³ Additional resources to promote physical activity are available from the US Physical Activity Alliance,²⁴ including the National Physical Activity Plan²⁵ and CDC's Active People Healthy Nation.²⁶

Based on the relationships among physical activity, obesity, immunity, and mental health we strongly urge health care, public health, education, workplace, and health insurance professionals and organizations to prioritize physical activity to leverage its acute benefits and immediate protection during the pandemic. Obesity-focused organizations should collaborate with diverse partners to advocate for improved, inspirational, and accessible resources for policy change, prioritizing physical education and activity in schools and programs to promote regular physical activity among people with obesity as well as the entire population to improve overall health and enhance resilience to future health crises. Schools can be a catalyst for change by prioritizing physical activity for every child and educating students and staff about its mental and physical health benefits. Targeted efforts to promote freely accessible activities such as walking could contribute to reducing inequities in COVID-19 morbidity and mortality.²⁷ We urgently need studies to test all the hypothesized protections among people with obesity in relation to COVID-19, including the impact of physical activity as a vaccine adjuvant. Public health organizations and health plans should develop internal and public communication campaigns that emphasize the importance of physical activity for the general population and more specifically for people with obesity as a mechanism to enhance immune responsiveness and potentially mitigate the severity of future infections, physically and mentally.

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References

1. Fryar CD, Carroll MD, Afful J. Prevalence of overweight, obesity, and severe obesity among adults aged 20 and over: United States, 1960–1962 through 2017–2018. NCHS Health E-Stats. 2020.
2. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of obesity among adults and youth: United States, 2015–2016. NCHS data brief, no 288. Hyattsville, MD: National Center for Health Statistics. 2017.
3. Physical Activity Guidelines Advisory Committee. 2018 Physical Activity Guidelines Advisory Committee Scientific Report. Washington, DC: U.S. Department of Health and Human Services, 2018.
4. Denay KL, Breslow RG, Turner MN, Nieman DC, Roberts WO, Best TM. ACSM call to action statement: COVID-19 considerations for sports and physical activity. Current sports medicine reports. 2020 Aug 1;19(8):326-8.
5. Popkin BM, Du S, Green WD, et al. Individuals with obesity and COVID-19: A global perspective on the epidemiology and biological relationships. Obes Rev. 2020;21(11):e13128.
6. Jayawardena R, Jeyakumar DT, Misra A, Hills AP, Ranasinghe P. Obesity: A potential risk factor for infection and mortality in the current COVID-19 epidemic. Diabetes Metab Syndr. 2020 Nov-Dec;14(6):2199-2203.
7. Anderson MR, Geleris J, Anderson DR, et al. Body Mass Index and Risk for Intubation or Death in SARS-CoV-2 Infection: A Retrospective Cohort Study. Ann Intern Med. 2020 Nov 17;173(10):782-790.
8. Zachariah P, Johnson CL, Halabi KC, et al. Epidemiology, Clinical Features, and Disease Severity in Patients With Coronavirus Disease 2019 (COVID-19) in a Children's Hospital in New York City, New York. JAMA pediatrics. 2020;174(10):e202430.

9. Cunningham JW, Vaduganathan M, Claggett BL, et al. Clinical Outcomes in Young US Adults Hospitalized With COVID-19. *JAMA Intern Med.* 2020 Sep 9;181(3):379–81.
10. de Heredia FP, Gómez-Martínez S, Marcos A. Obesity, inflammation and the immune system. *Proceedings of the Nutrition Society.* 2012 May;71(2):332-8.
11. Korakas E, Ikonomidis I, Kousathana F, et al. Obesity and COVID-19: immune and metabolic derangement as a possible link to adverse clinical outcomes. *Am J Physiol Endocrinol Metab.* 2020;319(1):E105-E109. 8.
12. Chastin SFM, Abaraogu U, Bourgois JG, Dall PM, Darnborough J, Duncan E, Dumortier J, Pavón DJ, McParland J, Roberts NJ, Hamer M. Effects of Regular Physical Activity on the Immune System, Vaccination and Risk of Community-Acquired Infectious Disease in the General Population: Systematic Review and Meta-Analysis. *Sports Med.* 2021;20:1–14.
13. Sallis JF, Pratt M. Multiple benefits of physical activity during the Coronavirus pandemic. *Revista Brasileira de Atividade Física & Saúde.* 2020;25:1-5.
14. Sallis R, Young DR, Tartof SY, Sallis JF, Sall J, Li Q, Smith GN, Cohen DA. Physical inactivity is associated with a higher risk for severe COVID-19 outcomes: a study in 48 440 adult patients. *Br J Sports Med.* 2021 Apr 13:bjsports-2021-104080.
15. Painter SD, Ovsyannikova IG, Poland GA. The weight of obesity on the human immune response to vaccination. *Vaccine.* 2015;33(36):4422-4429.
16. Pascoe AR, Singh MAF, Edwards KM. The effects of exercise on vaccination responses: a review of chronic and acute exercise interventions in humans. *Brain Behav Immun* 2014;39:33-41.
17. Nieman DC, Wentz LM. The compelling link between physical activity and the body's defense system. *J Sport Health Sci.* 2019;8(3):201-217.
18. Clemente-Suárez VJ, Dalamitros AA, Beltran-Velasco AI, Mielgo-Ayuso J, Tornero-Aguilera JF. Social and Psychophysiological Consequences of the COVID-19 Pandemic: An Extensive Literature Review. *Front Psychol.* 2020 Dec 16;11:580225.
19. Fearnbach SN, Flanagan EW, Höchsmann C, Beyl RA, Altazan AD, Martin CK, Redman LM. Factors Protecting against a Decline in Physical Activity during the COVID-19 Pandemic. *Med Sci Sports Exerc.* 2021 Jul 1;53(7):1391-1399.

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20. Caputo EL, Reichert FF. Studies of Physical Activity and COVID-19 During the Pandemic: A Scoping Review. *J Phys Act Health*. 2020 Nov 3:1-10.
 21. Jenssen BP, Kelly MK, Powell M, Bouchelle Z, Mayne SL, Fiks AG. COVID-19 and Changes in Child Obesity. *Pediatrics*. 2021 May;147(5).
 22. An R. Projecting the impact of the coronavirus disease-2019 pandemic on childhood obesity in the United States: A microsimulation model. *J Sport Health Sci*. 2020 Jul;9(4):302-312.
 23. Global action plan on physical activity 2018–2030: more active people for a healthier world. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.
 24. Physical Activity Alliance. <http://physicalactivityplan.org>. Published 2020. Accessed June 16, 2021.
 25. The National Activity Plan Alliance. (2016). *U.S. National Physical Activity Plan*. http://physicalactivityplan.org/docs/2016NPAP_Finalforwebsite.pdf.
 26. Centers for Disease Control and Prevention. Active People, Healthy Nation. <https://www.cdc.gov/physicalactivity/activepeoplehealthynation/index.html>. Last Reviewed April 21, 2021. Accessed June 16, 2021.
 27. Prevention. COVID-19 Hospitalizations and Deaths by Race/Ethnicity. <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html>. Published 2020. Accessed November 13, 2020.